THE
DIRECTORATE OF AEROSPACE FUELS

A Half Century of Excellence

The Directorate of Aerospace Fuels Management
San Antonio Air Logistics Center
Kelly Air Force Base, Texas

September 1999

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The Directorate of Aerospace Fuels Management

Providing quality fuel/missile propellant support
to our customers worldwide,
on time, at the right price, and at the right place …
in war or peace.

STS-58 Landing at Edwards AFB in 1993.

Atlantis on Shuttle Carrier Aircraft – 1993.

Foreword

The national defense of the U.S. depends on secure, reliable petroleum resources delivered when needed to the military services. For 50 years, the U.S. Air Force's Directorate of Aerospace Fuels Management and its predecessors have played a vital role in ensuring energy availability for the nation's aerospace forces.

In its historical evolution, the directorate gained a well-earned reputation as a one-of-a-kind organization. Directorate personnel continually stepped up to the challenges of dealing with new technologies, aircraft, and types of fuels to propel the finest air force in history.

The directorate soon transitions into a period of significant change. The first step of this journey occurs in October 2000 with an interim reassignment from the San Antonio Air Logistics Center to a Kelly AFB operating location of the Warner Robins Air Logistics Center. A year later, its people and expertise will transfer (in-place) to the Air Force Petroleum Office and the Defense Energy Supply Center.

Aerospace Fuels personnel, both past and present, should take pride in the rich heritage of the organization. Although the organizational names might change, the defense fuels community's mission and vision remains the same – An environmentally responsive team efficiently fueling the forces into the 21st century.

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We are grateful to all directorate personnel whose accomplishments make this story possible, and we dedicate this publication to current and past directorate team members.

THE
DIRECTORATE OF AEROSPACE FUELS MANAGEMENT

A Half Century of Excellence

B-2 “Stealth” Bomber in-flight refuel.

Aerospace Fuels – Life Force of Logistics

Mission, Organization and Resources

Throughout its half century of service, the Directorate of Aerospace Fuels Management and its predecessors have delivered worldwide logistical fuel support to the Air Force, other U.S. Government agencies, and international organizations. Directorate personnel provide the vital link between supply and consumption with responsibility in requisitioning, transporting, storing, distributing, and assuring quality in all Air Force fuels.

All directorate personnel contribute to the combat readiness of American and allied forces around the globe. Its people operate a multi-billion dollar complex organization with vital implications for our American forces around the globe. To handle this enormous enterprise, directorate personnel integrate resource, logistics, and inventory management with technical and engineering services, worldwide fuels quality assurance laboratories, and contracting.

No military operation can be undertaken without first considering the availability of fuel. Events of the past half century serve as vivid reminders for the necessity of this critical resource: the Korean War; the Cold War; the Space Race; the conflicts in Southeast Asia; the Persian Gulf; the Balkans; and other worldwide contingencies.

This document tells the story of the origins and evolution of aerospace fuels management, from its earlier days through the directorate's half-century of excellence.

SR-71 Blackhawk.

Directorate of Aerospace Fuels Management at San Antonio Air Logistics Center, 1999.

The Directorate – A Quick Tour of its Divisions

A quick tour of the directorate's five divisions in 1999 reveal the continuing heritage of which all current and past Directorate of Aerospace Fuels Management members can be proud.

The Resources Management Division exercises financial management for worldwide aviation, ground and missile fuels. In 1999, division personnel managed a $ 2.4 billion Air Force Fuels Stock Fund as well as other diversified support functions.

From left to right, George Willis, Mary Ann Schwarz, and Richard Gohn accept a 1994 $45 million reimbursment check for Navy in-flght refueling support provided by the Air Force during Desert Storm.

All U.S. Air Force aircraft refueling transactions are transmitted electronically to the division from more than 200 installations. The division also processes electronic transactions for aircraft refueling from Department of Defense (DoD), other government agencies, and over 60 international and commercial customers. This translates into more than one half million retail fuel transactions per month, totaling almost $300 million in sales.

The Logistics Management Division provides worldwide inventory management of missile fuels, chemicals, gases, propellants, cryogenic liquids, special fuels, and related hardware in support of military operations as well as national defense research and development. The division serves not only the U.S. Air Force but also the National Aeronautics and Space Administration (NASA), DoD, and the Department of Energy. Division personnel support universities, commercial space launches, allied governments, and also manages jet propulsion thermally stable fuel (JPTS) for U-2 reconnaissance missions and aerial survey missions flown by NASA's

ER-2. In addition, the division supplies liquid oxygen, hydrazine, and dinitrogen tetroxide for the Titan IVC and Delta rockets. To ensure the safe transportation of its hazardous products, it provides emergency response for shipments of dinitrogen tetroxide through its technical escort team.

Jet Propulsion Thermally Stable Fuel Intermodal Tanks.


Rail fuel tank cars managed by the directorate.

The Petroleum Resource Automated Management (PETROL RAM) Division supplies worldwide DoD acquisition and program management of the Automated Fuels Service Stations, Automatic Tank Gauging, and Automated Data Collection and Fuel Dispensing Systems. By capturing fuels transaction data at the source, these systems provide the on-line, real-time information required by the Fuels Automated System.

The Contracting Division provides cradle-to-grave acquisition support. Directorate contract specialists have implemented numerous acquisition reform initiatives to ensure the affordability of our products.

The Technical Division includes the Technical Assistance Branch, Product Engineering Branch, and the Laboratory Branch. Its personnel have set the standard for military fuel handling, dispensing, and quality control.

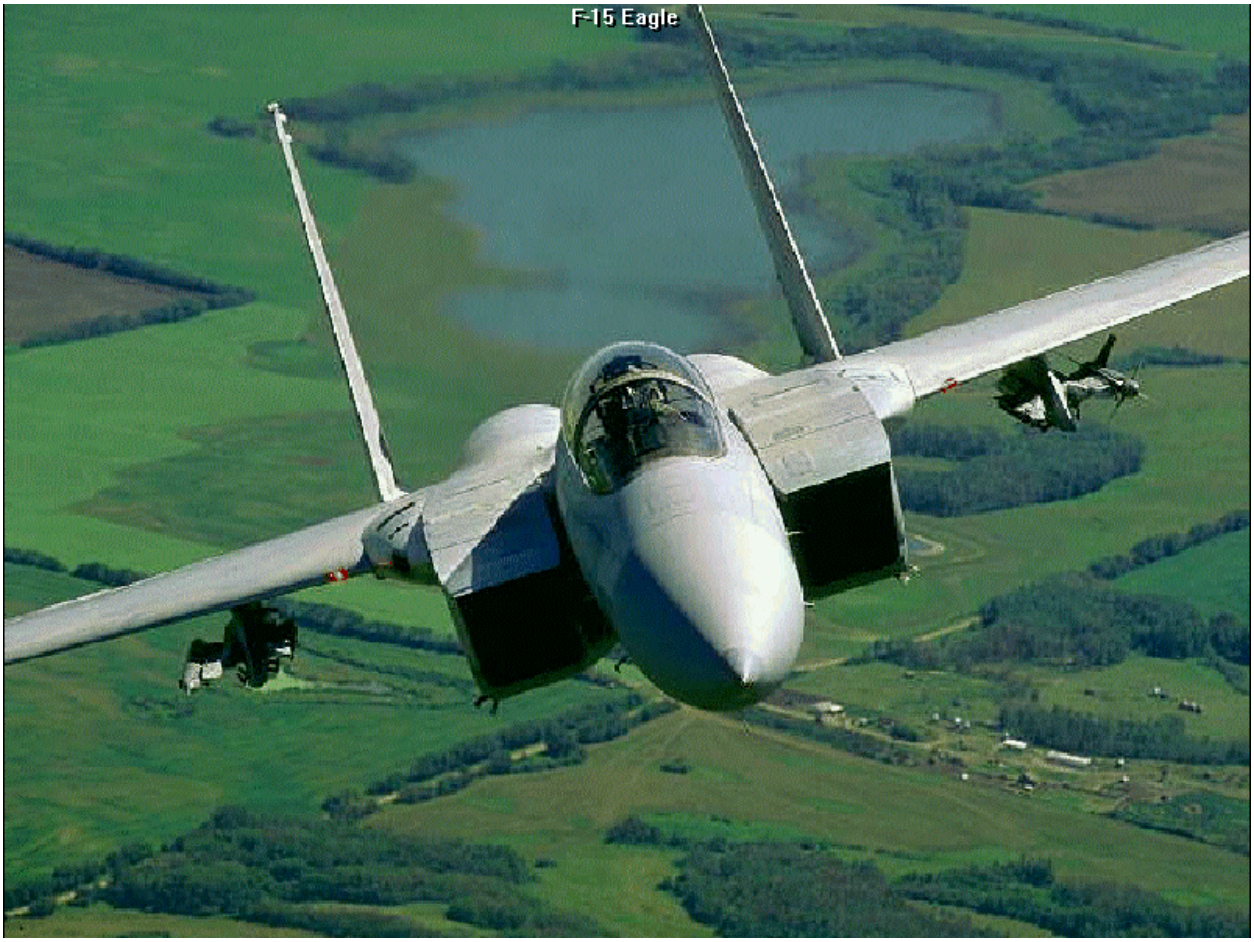
Within the Technical Assistance Branch, fuel specialists assigned to the U.S. Air Force's Petroleum Oil and Lubricants (POL) Technical Team respond at a moment's notice to prevent and correct problems at locations throughout the world.

The Product Engineering Branch provides the engineering and technical services for products such as ground fuels,

lubricants, chemicals, cryogenics fluids, missile propellants and compressed gases. Its chemists respond to customer requests for technical assistance and information. They also provide technical data for procurement documents, and write and review technical orders and specifications related to these products.

The Laboratory Branch of the Technical Division operates ten area laboratories worldwide that test over 40,000 petroleum, chemical, and liquid aviators' breathing oxygen samples per year. The quality assurance tests performed by the labs are an extremely important factor in maintaining safety in flight and on land for our military forces worldwide. In addition to aircraft fuels, the area laboratories test missile fuels, chemicals, greases, lubricants, compressed gases, argon, nitrogen, helium, liquid and gaseous aviators' breathing oxygen, coolants, hydraulic fluids, and ground fuels.

Aerospace Fuels Laboratory at Vandenberg AFB, California. One of the Directorate's ten worldwide laboratories.



F-15 Eagle.

The Formative Years of Aircraft Fuels: The Wright Brothers through World War II

The invention of the airplane and the need to fuel its flight created a fascinating aspect in the history of aviation. From the first flight of the Wright Brothers' biplane at Kitty Hawk, North Carolina in 1903 to the launch of the NASA Space Shuttle at Cape Canaveral, Florida, fuel has been a critical player. The technology, production, quality assurance and testing, procurement, and logistics of aviation fuels has undergone dramatic transformations in its short history. Each successive invention of more sophisticated propellers, jet engines, and space launch vehicles prompted the development of more advanced fuels.

Initially, the development of fuels and the associated infrastructure was slow. The airplanes of the 1930s did not require fuel much different from the gasoline that powered the original Wright Flyer. A publication of the day humorously stated – Don't you know that these new gas turbine engines can run on any fuel ranging from peanut butter to whiskey?

However, in 1939, the simplicity of fuels changed with the invention of the jet engine. Early jet fuels included: gasoline, used by Hans von Ohain in his first successful aviation jet turbine in August 1939; hydrogen, burnt in another test by Ohain; illuminating kerosene, used by Sir Frank Whittle in May 1941; and diesel fuel, which developers abandoned in 1941 because it froze during flight.

Soon, military and commercial aviation required a broad new spectrum of fuels for jets, ramjets, exotic jets, missiles, and others. An entirely new vocabulary developed.

Refuel trucks made drum servicing obsolete.

For jet fuels this language included Jet Propulsion (JP) fuels: JP-1 (1944), JP-2 (1945), JP-3 (1947), JP-4 (1951), JP-5 for the Navy (1953), JP-6 (1956), LF-1 and JPTS fuels for high-flying aircraft (1956), JP-7 (1970), JP-8 (1979), and JP-8+100 (1990s).

Commercial aviation fuels included Jet A, Jet A-1 and Jet B, and this was just the U.S. nomenclature. On the international front, there was a complex array of national specifications and names for these fuels.

Early missile fuels included RJ-1 (1956), RJ-4 (1960), RJ-5 (1960s) RJ-6, JP-9, JP-10, PF-1 (1970s). In a short span of time, fuels had become a high profile commodity which had to be continuously improved to meet the ever-changing technological, performance, quality, and safety requirements of our aviators.

Fuels Management Evolution

World War II saw a complex evolution of organizations managing the nation's military fuels. The requirement for aviation fuels grew so rapidly that a simple solution was difficult to find. Responsibility for wartime fuels fell under the Secretary of

the Interior, with central management exercised for the first time in 1941 by the Petroleum Coordinator for National Defense.

In 1942, fuels remained a responsibility of the Secretary of the Interior but fell under a new organization designated the Petroleum Administrator for War. The first agreement and Air Force office for Into-Plane Contracting (purchasing fuel for military aircraft at commercial airports) was also established in 1942 at Wright Field, Ohio, (today's Wright-Patterson AFB).

In 1943, the War Department transferred responsibility for domestic military fuels to the Joint Army/Navy Petroleum Board. Both the Army and Navy recognized the criticality of controlling fuels used in the combat theaters and thus promoted overseas management of these fuels. Due to this need, in 1943, the War Department established the Overseas Area Petroleum Offices and placed military fuels under the direct authority of overseas commands. Towards the end of World War II, when the U.S. military began experimenting with jet engines, the government recognized the expanding need to manage the new fuels' wartime usage.

The end of the war did not terminate the rapidly changing organizations created to manage military fuels. In 1945, the War Department created the Joint Army – Navy Petroleum Purchasing Agency for peacetime management of fuel. Just three years later, in 1948, the Armed Services Petroleum Board assumed control. In 1951, after the Korean War began, the Office of the Secretary of Defense (OSD) established the Petroleum Administration for Defense.

Fuel support operations were also evolving at the base or operational level. Flightline support transitioned into the modern day base fuels management organization by 1949, when the Air Force consolidated flightline and bulk storage operations into a fuels management branch. This evolution replaced the previous motor pool support of flightline fuels operations.

The complexity and importance of fuels support led to the concept of total life cycle control of fuels, from the refinery to the aircraft. Putting this concept into action lead to the birth of the Directorate of Aerospace Fuels Management (and its many name changes) as the U.S. Air Force sought to take cradle-to-grave control of its own fuel.

Over the next 50 years, the aerospace fuels organizations would ensure that the fuel and assigned commodity needs of the U.S. Air Force and our allies would be developed, procured, and delivered to meet customer requirements.

The 1950s – Fuels Centralization in the Cold War Era

Who Should Manage Fuels?

With the rise of the Cold War, the 1950s saw a dramatic increase in the logistical transportation needs for fuel supply throughout the world. It was clear that the size, dimension, and technical challenges of worldwide DoD fuels supply requirements were changing rapidly – with the U.S. military services having both common as well as diverse fuels needs.

Many DoD officials believed fuels management should be centralized. In 1951, the Petroleum Administrator for Defense, under the OSD, replaced the 1940s era fuels management organizations.

F5 refueling.

The question of organizational fuels alignment facing the DoD was still unresolved: The Air Force needed an internal organizational focal point for this vital commodity. Who should manage fuels?

Birth of the Fuels Division – 1952

In 1952, the Air Materiel Command (AMC) began decentralizing management of the federal stock classes to its various depots. The Air Force assigned fuels responsibilities to the Fuels Division, Directorate of Supply and Lubricants, reporting to the Middletown Air Materiel Area (AMA) at Olmsted AFB, Pennsylvania. Thus, the direct predecessor of the directorate was born.

B-47 to B-47 refueling.

KC-97.

But the debate over fuels management organizational structure continued with intensity. In 1953, OSD established the Petroleum Logistics Division. It was within this framework in 1955 that the Hoover Commission recommended a single Defense Supply and Service Administration. Implementation of this commission's recommendations led to the concept of a single item manager for each commodity.

Because of the Navy's worldwide presence, OSD saw that service as the

logical choice to manage fuel for all DoD. Consequently, on July 26, 1956, OSD designated the Secretary of the Navy as the Single Manager for Petroleum. The Air Force, despite being the major consumer, did not gain central responsibility.

Fuels Centralization

As the Navy took responsibility for military fuels management, the DoD activated the Military Petroleum Supply Agency on January 7, 1957. This agency directed and controlled all supply management functions assigned to the single manger for petroleum.

Its mission also included contracting for all commercial petroleum storage facilities and related services on a worldwide basis as part of the single manger's responsibilities. This agency assumed all procurement activities previously performed by the Armed Services Petroleum Purchasing Agency.

Expansion of the Directorate's Charter

In 1957, concurrent with the establishment of the DoD–wide Military Petroleum Supply Agency, the Fuels Division at Middletown became the Directorate of Air Force Aerospace Fuels. The U.S. Air Force gave the directorate inventory management responsibilities for 586 items.

In 1959, the organization's name changed to the Air Force Petroleum Directorate. Also in this year, the House Committee on Government Operations published the "Holifield Report" which recommended strengthening the single manager responsibility for petroleum. The report also recommended transferring single management assignment for petroleum from the Navy to the Air Force.

The Air Force reply to OSD, dated August 27, 1959, recommended that the military services retain ownership and distribution control over their own petroleum stocks. The Air Force stated that there was an absolute necessity for the service to retain control of fuels because it is vital to accomplishment of its mission and because of the overwhelming predominance of the Air Force expenditures in the petroleum commodity arena.

Oceangoing tankers deliver fuel worldwide.

During this time period new phraseology developed. Air Force bulk fuel stocks were referred to as "wholesale," "reserve," "war reserve," "stock inventory," and "retail stocks."

In 1960, the directorate went through another name change, becoming the Directorate of Air Force Petroleum and Chemicals, Middletown AMA.

Fuels Infrastructure

The fuels infrastructure established during the 1950s influences military and commercial fuels supply to this day. One of the programs started in the 1950s that still exists was the Air Force Pipeline Program. Begun in 1954, the program obtained pipeline connections to those U.S. Air Force bases that consumed large quantities of petroleum products.

By fiscal year (FY) 1955, the U.S. Air Force consumed 56 percent of all aviation fuel products used within DoD. The worldwide supply challenge was complex, entailing 193 bases in the Continental U.S. (CONUS), 90 bases overseas, and 166 into-plane commercial locations that supplied fuel to military aircraft.

This pipeline expansion effort continued throughout the 1950s and the 1960s. By 1967, over 1,389 miles of pipeline connections reached 59 Air Force bases and 38 retail distribution stations. These connections tied into more than 19,000 miles of commercial pipeline to move Air Force POL and enabled shipment of over two billion gallons annually through these pipelines

The Arctic Fuels Adventure

The cold war and aircraft technology brought about new challenges for our nation. The Air Force and the directorate found itself responsible for re-supplying fuel to hundreds of remote, hard to reach locations in the Arctic. With both superpowers now possessing long-range bombers, a new need arose to provide a protective early warning system around the U.S.

This arctic fuels chapter began on February 15, 1954, when President Dwight D. Eisenhower authorized construction of the Distant Early Warning (DEW***)*** Line – a primary line of defense against over the Pole attacks on the U.S. and Canada by the United Soviet Socialists Republic (USSR).

Between 1955 and 1957, massive amounts of supplies, fuels, and equipment had to be moved to the Arctic to construct over 58 DEW Line sites. From 1957 to 1959, the U.S. Air Force extended the line westward along the Aleutian Islands as well as eastward to four DEW Line sites in Greenland.

The Fuels Division provided fuel to the Dew Line.

Construction on a second Mid-Canada Line (a radio fence) also began in 1954. Located below the DEW Line, it used new Doppler technologies to detect aircraft. Spanning 2700 miles, this line became operational in January 1958. At its peak, it consisted of eight sector control stations and approximately 90 unmanned sites about 30 miles apart.

A third line called the Pinetree Early Warning Line provided triple protection against excursions. These stations, located on the sub-arctic tundra, presented huge transportation and construction obstacles.

The challenge of supply to these northern tier Arctic regions was daunting. Re-supply for the DEW Line by water transportation was possible only six weeks a year. Timing and advance planning were essential because weather considerations and ports and waterways had only limited storage space. As a result, arrival of cargo for outshipments had to be synchronized carefully with each vessels' arrival.

Predominance of Air Force Fuels

Other major changes were on the horizon. While ballistic missiles were still

in the research and development phase, in August 1955, the Air Force established the policy for future activation and integration of the first missile squadrons into the combat forces. In 1957, the Air Force established logistics support (including fuels) for missiles. Following the first Thor rocket launch at Vandenberg AFB in December 1958, the directorate established a laboratory on location.

By 1959, the magnitude of petroleum supply and distribution operations was staggering, representing 60 percent of the total procurement of petroleum for all the armed forces and 76 percent of the surface tonnage shipped by the Air Force within the CONUS. The amount of fuel the directorate managed equaled a train of tank cars over 5,100 miles long and included 34 different grades of fuels and over 600 petroleum product classifications.

The Air Force distribution systems spanned over 7,000 miles of common carrier pipelines tied to 18 bases with a planned additional 4,000 miles at nine more bases. It included 65 CONUS storage terminals. The North Atlantic Treaty Organization (NATO) Pipeline System serviced U.S. Air Force bases in Europe.

Aerospace Fuels Laboratories

In addition to the daunting logistics challenges of the 1950s, quality of the growing complexity of fuels and demanding needs of technologically advanced engines required an enormous expansion of fuels quality assurance and timely fuels testing. It is this era that spawned the origins and specialized capabilities of the aerospace fuels laboratories.

The directorate established five area laboratories during the 1950s, leading eventually to ten area labs by the 1980s.

Because of their rich heritage, a brief synopsis of each lab gives a glimpse into the diverse worldwide missions they have made possible for the DoD and our allies.

The Wright-Patterson Aerospace Fuels Laboratory.

The Wright-Patterson Aerospace Fuels Laboratory (Wright-Patterson AFB, Ohio), is considered the grandfather of the Aerospace Fuels laboratory system. Its formal organization dates to 1939. The Air Force assigned responsibility to the Middletown AMA in 1951, and subsequently to SA-AMA. Its expertise over the past 60 years has been in hydraulic fluids, specialty products, synthetic oils, aircraft ground fuels, and aviators' breathing oxygen. Additionally, its people have become experts in analysis of fuel products associated with aircraft incidents.

The Mukilteo Aerospace Fuels Laboratory (Mukilteo, Washington), was established in 1953, and provides support to activities in Alaska and other western states and Canada's provinces of the Yukon, Northwest Territories, British Columbia, Alberta, and Saskatchewan. An important part of its mission was support of the DEW Line and over 100 military installations in testing not only aviation fuels but also aviators' breathing oxygen, hydraulic fluids, fuel oils, and chemicals. With its specialized equipment, it also serves as the Air Force tester for greases.

The Searsport Aerospace Fuels Laboratory (Searsport, Maine), was

established in 1955 and was another of the initial DEW line support organizations, sustaining operations in the Canadian Arctic, Newfoundland, and Labrador. It also provided a full range of testing on fuels, POL products, and chemicals to 36 Air Force bases, terminals, and refineries in the northeastern part of the U.S. In the 1990s, it also became a key player in analyzing aircraft fluid samples from the B-1 and B-2 aircraft's hydraulic and Electronic Countermeasure systems.

The MacDill Aerospace Fuels Laboratory (MacDill AFB, Florida), also established in 1955, provides support to 112 major customers in the southeastern U.S., the Caribbean, Azores, and South America. Its tasking includes fuel analysis for the U-2 and TR-1 reconnaissance aircraft, testing of packaged petroleum products, identification of petroleum wastes as well as testing of fuels and gases. In the 1960s, it began providing primary reference standards for Spectrometric Oil Analysis (SOAP) testing worldwide, a vital service in reducing engine wear.

The MacDill Aerospace Fuels Laboratory.

The Vandenberg Aerospace Fuels Laboratory (Vandenberg AFB, California), was established in 1959 because of the cost benefits in co-locating a chemical lab with both government and industry to support missile and space programs. This eliminated the need for the major private aerospace contractors (Lockheed, Douglas, Convair, and Martin, for example) to operate duplicative facilities – and charge the cost to the government. Its specialties included analysis of fuels, liquid propellants, hydraulic fluids, pressurization gases, attitude control agents, and specialized chemicals. An important contribution to flight safety was the identification of substances that might cause contamination of missile systems.

The 1950s were pivotal years in the history of fuels management. The logistics and fuels management experience gained throughout the decade and the infrastructure laid down would influence how fuels logistics and operational support evolved.

Over the next three decades, the number of aerospace labs grew to the current ten with the addition of the Mildenhall, Cape Canaveral, Kadena, Holloman, and Aviano laboratories.

The Mildenhall Aerospace Fuels Laboratory.

The RAF Mildenhall Aerospace Fuels Laboratory (RAF Mildenhall, England) was established in 1979 to provide special fuels testing support for strategic reconnaissance missions throughout the European Theater. During the 1980s, its mission was expanded to support the testing of conventional jet fuels, selected lubricants, chemicals, and aviators' breathing oxygen. In the 1990s, its scope increased again to include environmental testing.

The Kadena Aerospace Fuels Laboratory had its beginnings in 1970 when the directorate established a co-located analytical laboratory at Machinato Army Laboratory, Okinawa, Japan. It provided testing of JP-7 for the SR-71 aircraft assigned to Kadena AB, Japan. In 1980, it was relocated to Kadena AB and expanded to provide analytical testing support in the Pacific region for fuels and compressed gases.

The Cape Canaveral Aerospace Fuels Laboratory (Patrick AFB, Florida), was transferred to the directorate in 1981. Work at this lab actually began unofficially in 1951, in Hangar 313 on Patrick AFB, Florida. Its existence became official in 1961 with the need to ensure fuel quality standards for the Thor, Atlas, Mercury, and Gemini rocket programs. Since that time, the lab has played a vital role in providing chemical and physical testing for military, National Aeronautics and Space Administration, and commercial space launches. Its support of environmental and hazardous waste characterization testing has made an important contribution to regional ecology.

The Cape Canaveral Aerospace Fuels Laboratory (back side).

The Holloman Aerospace Fuels Laboratory (Holloman AFB, New Mexico), was established as one of the directorate laboratories in 1983. At that time it supported 118 lab customers including Air Force bases, refineries, terminals, pipelines, and other DoD installations in five western states. In its earlier days as a local base lab, it originally supported the High Speed Test Track, better known as the "Rocket Sled."

The Holloman Aerospace Fuels Laboratory.

The Aviano Aerospace Fuels Laboratory (Aviano AB, Italy), became operational in 1988. It complemented the increased European workload facing the laboratory at RAF Mildenhall and provided responsive support to American forces in Italy, Turkey, Greece, Spain, Germany, France, the Middle East, and Africa. It played a major role in numerous contingencies including Operations Desert Shield and Desert Storm, Deny Flight, Southern Watch, and Allied Force.

The 1960s – Military Crisis and Technology Era

Fuels – A Billion Dollar Business

The directorate began the 1960s with its new name, the Directorate of Air Force Petroleum and Chemicals, Middletown AMA. By 1961, the U.S. Air Force's peacetime consumption of aviation fuel reached 5.9 billion gallons, which exceeded even the peak World War II consumption of 5.4 billion gallons. The technological innovations of the 1960's were dramatic. Sophisticated weapon systems required advanced fuels, efficient energy management, and a new fuels logistical infrastructure.

Technologically advanced aircraft consumed ever-increasing quantities of fuel. Aircraft built before World War II consumed, on average, only 40 gallons per-flying-hour. During World War II, this increased to 130 gallons-per-hour. However, fuel consumption by 1960 had increased to 833 gallons-per-hour. Fuels was now a billion-dollar plus operation.

If the annual fuels purchased for the Air Force during the 1961 era was placed in tank cars holding 10,000 gallons each, it would extend a distance of 5,300 miles or a distance from New York to Hawaii. Fortunately, the Air Force common carrier pipeline program, which had begun in the 1950s, continued towards its goal of being able to transport over two billion gallons of fuel through pipelines throughout the CONUS and overseas to DoD installations.

The increased POL consumption of the 1960s dramatically influenced the way the directorate conducted business. To succeed, the organization not only had to recognize these challenges, but anticipate and implement technology to meet them. Directorate personnel adapted and learned a new vocabulary that included such unfamiliar terms like SOAP, POL Tech Team, "moon juice," the "Fuels Bible," and computers.

Fuels themselves continued to evolve. On October 30, 1961, Headquarters U.S. Air Force approved a program to include an anti-icing additive in JP-4. This authorization was obtained as a result of a B-52 crash at Ellsworth AFB, South Dakota, in 1958. The extensive research and testing programs initiated by the directorate continue to prevent similar incidents.

Worldwide Directorate Operations

Directorate personnel practiced process reengineering, business reengineering, and just-in-time logistics decades before these terms became popular. On May 1, 1961, the Directorate of Air Force Petroleum and Chemicals was re-designated the Directorate of Air Force Aerospace Fuels, Chemicals and Petroleum Products. This subtle name change to include "Aerospace" reflected the directorate's expansion, first into liquid propellants and oxidizers, then into hundreds of new petroleum products.

In addition to its headquarters at Middletown AMA, the directorate had personnel assigned at 12 worldwide locations. These included five U.S. Air Force aerospace fuels laboratories: Mulkiteo, Vandenberg AFB, Wright-Patterson AFB, Cape Canaveral, and Searsport. The directorate's U.S. Air Force field petroleum offices, managing fuels supply and transportation, were located at Houston, Texas; Middletown, Pennsylvania; Lynn Haven, Florida; St. Louis, Missouri;

Maywood, California; and Newfoundland, Canada.

Technology also transformed business practices. In 1962, the directorate replaced its vacuum tube era IBM computer with a state-of-the-art fully transistorized electronic data processing machine. And for the first time, the directorate initiated a study for mechanizing the functions within the Aviation Fuels Division of the Air Force Stock Fund. This encompassed fuels accounting and supply at base, terminal, and command level operations and petroleum operations at Headquarters U.S. Air Force. The vision was that computer technology could "provide the Aviation Fuels Stock Fund manager with all the necessary management data on a timely and accurate basis."

The Space Age Begins

The space age dawned with the October 1957 launch of a Soviet earth satellite called Sputnik I. Sputnik I stayed in orbit 92 days and ushered in the era which was climaxed by the historic landing of Americans on the moon in July 1969. Prior to Sputnik I, a deterrent force of intercontinental ballistic missiles (ICBM) was the number one consuming program for directorate missile fuels and propellants support personnel.

Missile fuel support came into being as a special category of fuels in July 1958. During the next four years, people at the Middletown AMA procured all propellants, oxidizers, and pressurants for the missiles, while using fund citations from various commands, agencies, and centers. On July 1, 1962, the directorate instituted a missile propellant fund and a separate division was born. The creation of this organization reflected the growing importance Americans placed on the space program.

Titan Missile Launch.

Four years earlier, in August 1958, DoD decided to have the Army's Ballistic Missile Agency, headed by Dr. Werner Von Braun, develop a super rocket to close the gap with the USSR. In July 1960, the Von Braun team and its Saturn project transferred to NASA. In May 1961, President Kennedy declared that the U.S. would land a man on the moon before the end of the decade. At this time, rocket fuel consumption was limited to small quantities for operational and experimental use. However, that changed in 1963 as directorate personnel supported the rapid build up of ICBM deterrent forces and the concurrent research and development of both ICBMs and space boosters.

The directorate excelled in the new space age environment. As engineers and technicians fought to solve the engineering and mechanical problems of the new Titan II

program, fuels managers fought to keep the pipelines full. Missile technicians and fuel supply manager's came of age together, and the Titan II was fully operational several weeks before the target date of December 31, 1963.

The SOAP Program

The Air Force first initiated its test program for SOAP on jet aircraft in May 1963. At that time, SOAP was a relatively new procedure for the military. It provides extremely sensitive detection of engine wear particles in oil samples. The equipment makes vaporized oil samples emit light in pattern much as a prism splits sunlight into the separate wavelengths of the rainbow. The test reveals quantitative amounts of metal particles produced from engine wear. This information enables maintenance personnel to diagnose and predict failures of mechanical parts before they happened in oil-lubricated, enclosed, mechanical systems. This program proved spectacularly successful in reducing aircraft operational risks and maintenance.

In March 1964, the Air Force issued a directive to implement SOAP for all its single and twin-engine fighter aircraft and assigned testing responsibility to the directorate on June 12, 1964. Four aerospace fuels laboratories performed testing and analytical development. The MacDill Aerospace Fuels Laboratory served as the technical authority for SOAP and developed most of the engine wear criteria used in 1999. On April 19, 1966, SOAP entered an expanded second phase when the directorate became the program manager for all U.S. Air Force bases.

In July of 1967, the directorate sponsored the first worldwide SOAP symposium, hosting 300 experts from across the nation and abroad. Although commercial as well as military programs had expanded rapidly, no attempt prior to this had been made to coordinate and standardize the efforts of the two groups. In his address at the conference, Major General Harold E. Humfeld, Director of Maintenance Engineering at Headquarters U.S. Air Force, compared SOAP with "a blood analysis to get a picture of a patient's health."

On May 15, 1969, Defense Department officials extended the oil analysis program to all military equipment, not just aircraft, and designated the U.S. Navy to establish, manage, and coordinate a DoD oil analysis program.

On November 1, 1970, the directorate transferred its responsibility for both base level and Air Force Logistics Command SOAP programs to the San Antonio AMA Directorate of Materiel Management. In only six years, from 1964 to 1970, the directorate demonstrated, and successfully institutionalized a viable SOAP program, one that yielded significant safety benefits and cost savings to DoD.

POL Technical Assistance Team

In February of 1964, the directorate established the Air Force POL Technical Assistance Team as a trouble-shooting group – a unique element of fuels support to maintain the readiness of U.S. forces. These highly qualified engineers, chemists, and quality assurance specialists served as consultants worldwide to DoD, industry, and the international fuels community in delivering rapid response and ongoing solutions to fuels technical problems.

Southeast Asia Fuels Supply

Concurrent with the technological innovations of the 1960s was the directorate's support of military operations.

One of the most dramatic logistical accomplishments during the Vietnam War was the construction of dependable aviation fuel supply complexes throughout Southeast Asia. In the early sixties, the only significant fuel storage facilities available in Vietnam was in the Saigon area, and it was extremely vulnerable to sabotage and attack. Thus began the task to establish land and floating storage terminals on the Vietnamese coast.

American military forces rapidly built ocean bulk petroleum terminals along the Vietnam coast. At Cam Ranh Bay, Nha Trang, and Qui Nhon, new terminals supplied fuel to American and allied air and ground forces. A U.S. Air Force terminal was constructed in Da Nang. At Tuy Hoa Air Base, which began as a bare base, the Air Force established a complete petroleum storage and dispensing system capable of resupply from oceangoing tankers. The Air Force constructed another bulk petroleum terminal at Sattahip, Thailand, to supply a new base at U-Tapao, Thailand. The first fuel shipments were made there in July 1966, permitting U-Tapao to become operational later that same year.

The directorate's role in the conflict in Southeast Asia expanded in 1967 when it established analytical laboratories at Tan Son Nhut AB, Vietnam and Korat AB, Thailand, to monitor the quality of aviators' breathing oxygen for the protection of air crews. These laboratories improved response times for analysis of samples to meet the increasing role the Air Force had over the skies of Southeast Asia.

Cape Canaveral – The Space Dream

On 6 July 1966, the directorate received single manager responsibility for liquid propellants and pressurants for both the Air Force and NASA, including the Cape Canaveral and Kennedy Space Center complexes. The directorate's propellants charter expanded to include supply to other non-defense agencies.

In 1968, directorate personnel began supplying propellants to the Atomic Energy Commission. Furthermore, the directorate had responsibility for all Air Force industrial chemicals and gases. In early 1967, directorate officials renamed the Aviation Fuels Division to the Fuels Division to recognize its expanded responsibilities into missile propellants and selected ground fuels.

The Apollo 7 mission in September 1968, illustrated the extraordinary effort it took to support NASA space launches. To support this mission, a total of 8,875 tons of liquid nitrogen, 1,082 tons of liquid oxygen, and 728 tons of RP-1 had to be delivered and be in a ready status for several weeks prior to liftoff. Despite these enormous requirements, directorate personnel met exacting quality standards, including one for 99.99 percent pure oxygen.

The Air Force assumed complete propellants support for NASA in FY68. The Saturn V launch of the Apollo 8 moon orbiter in December 1968 was successful as the directorate delivered fuel on time despite numerous challenges due to several

unplanned fuel/oxidizer system checks, all requiring full propellant loads.

The directorate demonstrated the economic and operational benefits of its role as a single manager with the Saturn 1B launches of the Apollo 8 and 9 flights, the Apollo landings on the moon, and the Titan program. Newspaper articles at that time referred to the directorate's unique role in providing "moon juice" for the Apollo and "fuel for the bird" for the Titan. Fill 'er up took on a new meaning in the organization.

Going to the Moon – Fuels Connection

View from Apollo 11, 1969.

President Kennedy's promise to land a man on the moon by the end of the decade was fulfilled with the launch of Apollo 11 on July 16, 1969. Four days later, on July 20, man accomplished the long-time dream of walking on another celestial body. For Apollo 11, fuel supplied by the Directorate to the Kennedy Space Center totaled 8,860 tons of liquid oxygen and 2,755 tons of liquid nitrogen.

Cost of the fuels consumed on this trip to the moon was approximately $350,000. Considering the cost equated to a mere 73 cents per mile, the flight demonstrated the economic viability of future space programs.

Directorate workers successfully supplied propellants and pressurants to the second manned lunar landing mission (Apollo 12), which NASA launched on November 14, 1969. A major initiative in making these Apollo supply efforts successful was a new pipeline at the Kennedy Space Center to carry gaseous nitrogen.

The integrity of the products supplied by the directorate was illustrated with the launch of Apollo 13 on April 11, 1970. An accident in the command module that decimated the spacecraft's oxygen supply and shorted out the electrical system caused a mission abort after only two days and 205,000 miles in space. As history records, the supply and quality of life-saving oxygen held, and the crippled ship returned home.

On the Road Again…to San Antonio

In the mid-1960s, President Johnson's administration sought ways to pay for the expanding conflict in Southeast Asia without derailing the social programs being implemented at home. One of these options was to close military bases, and OSD selected four Air Force depots for closure, including Olmsted AFB and its tenant, Middletown AMA. Consequently, on August 29, 1966, the Directorate of Air Force Aerospace Fuels moved to its new home as part of the San Antonio Air Material Area (SAAMA) at Kelly AFB, Texas. This transfer involved the relocation of over 100 of the 400 people assigned, led by the director, Colonel Carleton G. Shead. This new SAAMA organization moved into Building 232, which had previously been the base dispensary.

Earlier in 1966, the supply management and accounting function for Air Force bulk and packaged petroleum office moved from Olmsted AFB to

Cameron Station, Virginia. It remained part of the directorate but was renamed the Aerospace Fuels Petroleum Supply Office, commanded by Colonel Luther Morefield.

In 1966, the Directorate of Energy Management moved to Building 232 at Kelly AFB .

1966 – The Expansion Year

The directorate's mission continued to expand in the 1960s, assuming single manager responsibility for liquid propellants in 1966. On October 28, 1966, the directorate developed aircraft sampling procedures along with test methods for Aerospace Laboratories to include aviation fuels and hydraulic fluid systems.

Also in 1966, the directorate's Quality Division created the American Petroleum Institute (API) Trophy. This highly coveted award culminates in an annual competition supported by the API. Fuels equipment, facilities, and flight personnel are thoroughly inspected by personnel from HQ USAF and the Director, Aerospace Fuels Management, to determine the base with the best overall fuels operation (See Appendix 2 for a list of API winners.)

The directorate also had the distinction of being one of the first organizations to use U.S. Air Force Reserve Individual Mobilization Augmentees (IMAs) beginning in the early 1960s. This highly experienced reserve force was totally integrated with the directorate's active duty military and civilian personnel as part of the Total Force concept. In 1966, 24 highly experienced reservists (chemists and fuels officers) augmented the active duty force at laboratories, operating locations, and Kelly AFB.

The Financial Side of Fuels

On December 1, 1966, the directorate revolutionized the system for recording into-plane contract fuel issues to DoD aircraft by providing contractors with imprinters. This procedure simplified the manual paperwork involved in off-station fuel purchases and provided a standard data input which could be easily and rapidly read by keypunch operators at the central data services office. The result of this action insured timely reimbursements to the Air Force Stock Fund.

In early 1967, the directorate received responsibility for implementing and managing the fuels division of the Air Force Stock Fund – the only stock fund assigned at the air materiel area level. This initiative was one of the earliest actions in the DoD plan to establish an integrated programming and financial management system.

Additionally, in July of 1967, directorate personnel began providing propellant support to NASA's manned space program along with the Marshall Space Flight Center, Langley Research Center, Mississippi Test Facility, and Wallop Island Test Station. The Missile Fuels Division continued to grow.

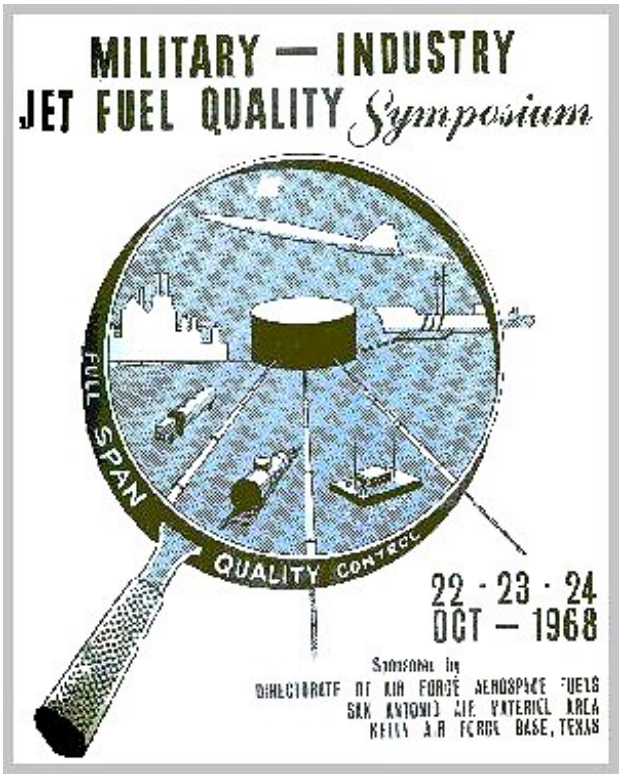
Full Span Quality Control – 1968

In October 1968, Colonel Shead sponsored the first Jet Fuel Quality Symposium. Held in San Antonio, Texas, the symposium provided an military – industry forum to discuss present and future

issues associated with jet fuel quality and established common goals. Attendees included 600 executives and experts from refineries, airlines, airframe manufacturers, engine companies, modes of transportation, storage and handling equipment firms, as well as all military services.

This was the first time that a diverse yet common group of this magnitude had met to explore the issues of jet fuel quality from a total systems concept, including the entire life of fuel from the refinery to final consumption by the aircraft. Alvin T. Traynor, Chief of the Quality Division, coined the phrase "full span quality control" which represented a new cradle-to-grave philosophy for fuels. Over 75 different presentations were given and discussed in working sessions. New infrastructure to handle contaminated fuel and revising fuel handling concepts were major themes.

In November 1969, the directorate published what fuels specialists nicknamed the "Fuels Bible" (Air Force Base Fuels Operations Manual, AFM 144-1), and Air Force fuels prepared to enter the turbulent and challenging decade of the seventies.



Directorate sponsored the first Military – Industry Jet Fuel Quality Symposium in 1968.

An F-15 Eagle taxis in to hot pit refuel. The directorate's POL Technical Assistance Team focuses on providing improved fueling support for USAF operations worldwide.

The 1970s – The Energy Crisis

Big Business

The directorate began the seventies with 354 personnel (38 military, 316 civilians). On July 1, 1973, wholesale management of bulk petroleum was realigned from the directorate to the Defense Supply Agency (DSA). This meant the directorate's responsibility began at the base boundary, instead of at the source. The directorate lost five CONUS field offices and 146 personnel to DSA.

The realignment did not mean POL requirements were decreasing. On the contrary, the directorate financed the Air Force flying program with ever increasing multi-million, and, in the late seventies, multi-billion dollar budgets. Fuels support was big business.

The Energy Crisis

The 1970s energy crisis shocked the world! As war erupted between Israel and its Arab neighbors in October, 1973, the Middle Eastern oil exporters immediately cut off oil shipments to countries supporting Israel. Industrial nations experienced a end to the belief that fossil fuels would always be plentiful. President Nixon ordered an immediate seven percent reduction in energy use by U.S. federal agencies.

With limited availability of POL products, the directorate struggled to supply Air Force aviation fuel needs. By diverting hundreds of thousands of gallons of JP-4 to the Military Airlift Command, the directorate insured support and delivery of vital material to military accumulation points for airlift to Israel.

In addition, a real challenge faced the directorate on how to guarantee availability of sufficient quantities of aviation fuels. Unfortunately, although fuel was a strategic material, it could not be stockpiled because the annual demand was so great.

The energy crisis provided the impetus to search for synthetic fuels, to decrease aircraft fuel consumption, and to broaden the range of fuels used by jet aircraft. In addition to concerns raised by the energy crisis, safety issues needed new solutions. Experience gained from combat operations in Southeast Asia intensified efforts to find a fuel safer than JP-4. Environmental issues regarding the safe handling and disposition of chemicals also presented technological and economic challenges.

An International Defense Fuels Leader

In 1973, the directorate chaired a Federal Energy Office committee, which issued regulations on refinery oil yields. Directorate personnel represented the U.S. Air Force at Joint Technical Coordinating Group conferences, which formulated DoD policy on fuels standardization. The Technical Division served as the principal delegate representing the U.S. at NATO standardization meetings where international standard agreements called STANAGS are formulated. This job included a principal role on NATO's Aircraft Gaseous Working Party, the Fuels and Lubricants Working Party, and committees on Petroleum Handling Equipment. The directorate also served as NATO custodians for numerous fuel related STANAGs. This significant role continues into the 21st century – insuring interoperability of fuels with our NATO allies.

Special Fuels

During the seventies, the directorate continued to supply JPTS for the U-2 and JP-7 for the SR-71 aircraft. In addition to aviation fuels, the missile fuels business grew exponentially. By the early 1970s, the directorate had over three hundred consumers of propellants located throughout the U.S. at launch sites, testing facilities, and missile bases.

SR-71 Blackhawk.

Seven major special fuel users included: NASA manned flights at Kennedy Space Center; NASA's Houston Space Center; the U.S. Air Force Eastern Test Range for satellites; engine testing at the Marshall Space Center; Saturn rocket static firing at the Mississippi Test Facility; ICBM test launches at the U.S. Air Force Western Test Range; and the Atomic Energy Commission.

A Short Move – 1973

In August 1973, the directorate moved (although this time only a short distance) from Building 232 on Kelly AFB, to the northwest corner of Building 171. Approximately 130 directorate personnel worked at Kelly AFB with the remainder assigned to six laboratories dispersed throughout the U.S. and at the Petroleum Supply Office at Cameron Station. In April 1974, HQ U.S. Air Force assigned the directorate's Detachment 29 at Cameron Station the responsibility for developing pre-positioned war requirements for ground fuels, pre-positioned war reserve stock, and peacetime operating stock. Thankfully, data automation in this embryonic computer age had finally arrived! By December 1974, the directorate developed the first mechanized publication of a Ground Operating Fuels Logistical Area Summary. Det 29 continued operations until 1995, when manpower reduction measures forced its closure.

Energy Management

In August 1975, the Directorate of Aerospace Fuels was renamed the Directorate of Energy Management. In addition, the directorate changed from a commodity-oriented operation to a functional domain. This change resulted in the end of the Propellants, Chemicals and Gases Divisions and the establishment of a Materiel Division, which handled requirements, distribution, and the Logistics Management Division for planning, programming, emergency war plans, and data automation.

Colonel Merle W. Nash, Energy Management Director from 1975–1977, stated that while the directorate would continue its role in securing fuels and propellants, considerable emphasis would be placed on developing alternate energy sources and technology for conservation of existing resources.

Propelling these changes was the rapidly escalating cost of energy. Although the Air Force reduced its energy use by one-third after the energy shortage began, the directorate's budget in 1975 had increased from $800 million to almost $2 billion due to price increases.

The directorate now provided over four billion gallons of fuels, oils, chemicals, and liquid missile propellants to Air Force bases around the world. Cost increases were dramatic. In July 1975, the cost of the major fuel product, JP-4, was 42.3 cents per gallon. This was a 31-cent per gallon increase over the pre-embargo price of only 11.3 cents a gallon! By July 1976, the Air Force placed all bulk petroleum fuels under the single management of the directorate.

Safety Issues

Safety issues also began to take center stage. In 1971, based on experiences in the Vietnam War, the Tactical Air Command requested a safer, less volatile fuel for use in fighter aircraft. Serving on a joint coordinating group and participating in propulsion studies, directorate technical personnel researched the feasibility of a one fuel concept for DoD. JP-8 became the fuel of choice. Similar to commercial Jet A-1, but with corrosion inhibitors and anti-icing additives injected, JP-8 proved to be safer for fighter aircraft due to its high flash point.

In 1975, the Secretary of the Air Force directed future aircraft be capable of using JP-8. In the same year, DoD policy directed all new turbine engines be designed to operate on JP-8 as well as JP-4 and JP-5. In 1976, NATO agreed to implement JP-8 (NATO F-34) as the standard fuel for land based jet aircraft in Europe. England and France had already adopted JP-8 five years earlier. However, a series of cost, logistics, and availability issues delayed the eventual conversion of U.S. aircraft for almost 20 years.

Agent Orange – Supply and Disposition

From 1962 to 1970, U.S. and allied forces used large quantities of defoliants, mostly Agent Orange, during the Vietnam War as a means of stripping enemy cover, thus limiting hiding places and availability of food supplies. Until April 21, 1969, the directorate managed the herbicides used during this conflict.

Agent Orange Storage in barrels.

In June 1970, the U.S. Government suspended the use of Agent Orange and faced the difficult task of safe storage, handling, and disposal of 2.3 million gallons of the deadly chemicals. Over seven years of research and environmental impact studies were conducted to determine the safest disposal options.

Agent Orange disposition methods considered included deep well injection, burning, biodegradation, fractionation (reducing Agent Orange to its basic components), conversion to other herbicides, conversion to carbon tetrachloride, burial with sewage sludge, and others. Agent Orange supplies were finally transported by ship, beginning in March 1977, from Gulfport, Mississippi, to Johnston Island in the middle of the Pacific Ocean, where they were incinerated.

Fuel Support for Space Programs

Support of both on-going launches as well as complex future space programs continued full speed ahead during the

seventies. The Propellants Division supported all Apollo missions, ending with Apollo 17 on December 6, 1972. The division also supplied propellants for the four Skylab launches in 1973-74. Skylab was this country's first earth-orbiting space station, launched by a Saturn V rocket on May 14, 1973.

The 1970s also saw development of the space shuttle - a radical idea using conventional vertical rocket-powered takeoff with a reusable spaceship that could land like an airplane, a combination of aeronautics and astronautics. As envisioned, space shuttles would transport astronauts and scientists, equipment, laboratories, satellites, and propulsion stages to and from the earth. The directorate's role in the development and supply of liquid propellants for the future shuttle was an important element in making this program of the future a reality.

Diversified Products

On October 1, 1973, directorate personnel received a new product responsibility – management of deuterium gas. The sole source for heavy water from which deuterium is produced was the Atomic Energy Commission's Savannah River Plant. Deuterium was used as a fuel in small rocket engines and in controlling the nuclear fusion process.

Additionally, the Air Force and Navy used this gas in high-energy laser research, since deuterium, in combination with fluorine gas, produced powerful laser beams. Because of the energy crisis, scientists believed deuterium's greatest future importance was in fusion research as the national drive for energy self-sufficiency intensified.

The Propellants Division provided liquid oxygen, liquid nitrogen, and gaseous nitrogen to smaller but equally famous NASA programs. This included launches of weather and communication satellites and the unmanned Mariner and Pioneer exploratory flights to Mars, Jupiter, Mercury, and other planets in our solar system. In 1972, the directorate provided neon for the Synchronous Meteorological Satellite (SMS). Directorate support led to the successful launch of the satellite 22,000 miles into space. SMS revolutionized the accuracy of weather forecasting and continues to take pictures all of us watch on television weather reports into the 21st century.

On August 11 and August 21, 1975, the directorate embarked on another world (solar system) "miles-per-gallon" record by supplying fuels for the twin Voyagers on their Viking Mars missions. Each of these spacecraft traveled over 440 million miles on their journey to reach Mars by July 1976. This space flight also marked the first time a US high-energy upper stage rocket (the Titan IIIE Centaur) used liquid hydrogen as a propellant. Other fuels supplied included liquid nitrogen, oxygen, hydrogen peroxide, neon, nitrogen tetroxide, liquid helium, unsymmetrical dimethylhydrazine (UDMH), and hydrazine.

Cryogenics and Hydrazine Challenges

The unique role the directorate played in cryogenic support included liquid argon, liquid fluorine, liquid neon, liquid hydrogen, and liquid helium – all icy cold gases with boiling points between –297 and –452 Fahrenheit. Since they revert to their gaseous states above these extraordinarily low boiling points, they all require special handling and transportation in insulated tank cars, tank trucks, and cylinders. Furthermore, the hazardous nature of these substances requires special safety considerations and expertise.

The management of hydrazines, which were important to many programs during the seventies, also presented significant supply, transportation, and storage challenges. These fuels included anhydrous hydrazine, monomethyl hydrazine, unsymmetrical UMDH, and hydrazine/UMDH mix. One of the better known applications of these fuels was the UDMH and hydrazine mix used to power the U.S. Air Force Titan II and Titan III missiles for satellite launches.

Unique Programs

In addition to missile programs, hydrazine played a prominent role in a number of other unique programs. A Navy program used a hydrazine consuming gas generator to repeatedly raise and lower a monitoring device from the ocean floor. This technology permitted collection and transmission of various data including temperature, salinity, and surface conditions 50 times per week. The Energy Research and Development Administration employed hydrazine to provide underground detonations to increase petroleum product recovery. NASA also powered a high altitude environmental sampling craft called the Mini Sniffer by a hydrazine engine.

In 1976, the directorate played a vital role when the joint American-Soviet space forces launched the Apollo-Soyuz Project, which involved in-flight testing of a jointly designed international docking mechanism. Astronauts and cosmonauts also performed numerous space experiments during this mission, which laid the ground work for future cooperation between the U.S. and the USSR, ensuring space aid in emergency situations.

On December 6, 1976, the Defense Fuels Supply Center (DFSC) transferred management of JPTS to the directorate. In addition, the U.S. Air Force consolidated responsibility for JP-7 with JP-8 and JP-9. In the seventies, JP-9 was referred to as a "punch and distance" fuel for a highly classified, new weapon system – the Air Launched Cruise Missile (ALCM). Eventual conversion of aircraft to JP-8 from JP-4 was still in the concept stage.

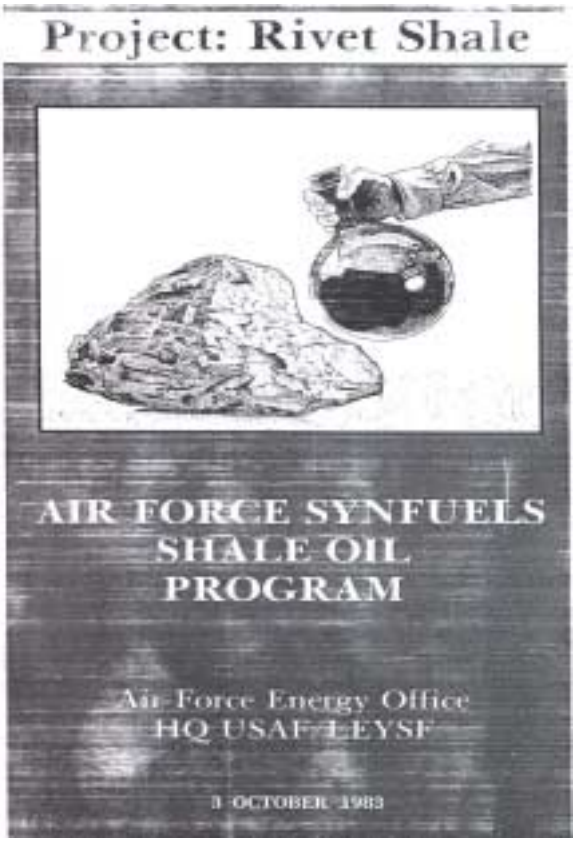
The directorate's unique mission expanded to include new research functions, development of new fuels, sources of energy, energy conservation projects, fuel handling safety, and Environmental Protection Agency (EPA) compliance for specialized areas. The directorate was well prepared and proved to be a DoD and industry leader.

"Keep America Running" – Shale Oil

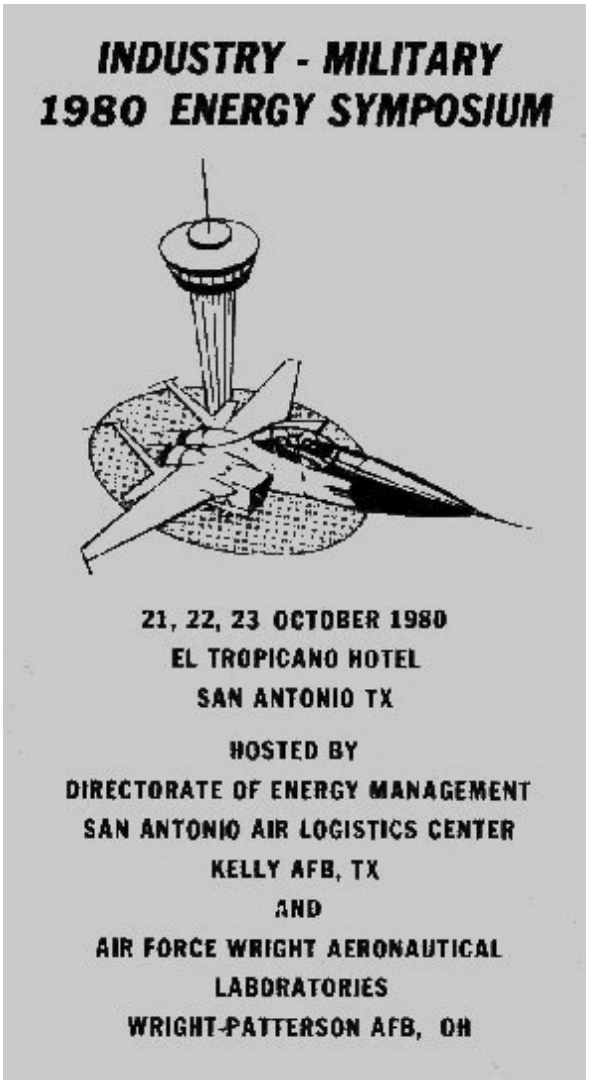
One interesting mission directorate personnel became involved in due to the energy crisis was identifying and finding alternate fuel sources, preferably domestic, to ensure mission readiness. As part of the "Keep America Running" campaign, the Quality Division, under the leadership of Nick Makris, continued its unique role as consultants to the Shale Oil Research and Development Program to produce synthetic JP-4 fuel. In 1975, under the technical support of directorate personnel and the Air Force Systems Command, an Air Force T-39 aircraft was flown from Wright-Patterson AFB, OH, to Carswell AFB, TX on JP-4 refined from shale oil.

Potential payoffs were immense since over one trillion barrels of shale-oil deposits in the Naval Oil Shale Reserves at Anvil Points in western Colorado alone could eventually become a commercially and technically viable source of energy. By 1975, over 10,000 barrels of fuel had been produced using a "Parraho Recovery" process. In the early 1980s, directorate

personnel estimated that JP-4 fuel derived from coal using proven technologies could be available to the Air Force at an approximate cost of $4.16 per gallon (in 1981 dollars). In August 1981, the directorate distributed an operational validation plan for the use of JP-4 grade jet engine fuel derived from shale oil. Major Larry R. Dipoma, Chief of the directorate's POL Technical Assistance Team, was actively involved in determining the suitability of this fuel for tactical aircraft from 1982 to 1984.



In 1983 the directorate conducted a test using JP-4 derived from shale oil in fighter aircraft at Mountain Home AFB, Idaho, and Hill AFB, Utah. The shale oil-derived fuel had to conform in every respect to the specifications for conventional jet fuel. Despite a number of technical successes with the quality of the fuel, shale oil derived jet fuel proved too expensive, and officials put the program back on the shelf to await future development.



The directorate took the lead in sponsoring industrial and military conferences.

The 1980s - Logistics Readiness Era

Excellence Recognized

The Air Force recognized the directorate's accomplishments in 1981 when it received the Air Force Organizational Excellence Award for its performance from 1979 to 1981, a period of extreme change in management of energy with diminishing supplies and escalating prices. The award citation stated that "the Air Force had achieved the greatest savings in petroleum utilization of any agency of the U.S. Government and no operations were curtailed due to lack of supply of fuels."

Air Launch Cruise Missile.

Continuing Missile Program Support

As part of the military buildup during President Ronald Reagan's two terms in the 1980s, missile support continued to demand much attention from the directorate. When Boeing Aerospace Company won the DoD contract to produce ALCMs, directorate personnel managed the production and testing of the fuels used in the new weapon system. Continuing ICBM requirements called for support of Minuteman missiles.

The Homing Overlay Experiment in 1983 and 1984 and the Army's testing of anti-ballistic missile systems required various cryogenic products, such as liquid nitrogen and oxygen, hydrazine, nitrogen tetroxide and helium. The directorate furnished and arranged for the shipping of the fuels and gases to the test site at the Kwajalein Missile Range in the South Pacific, both by sea cargo and C-141B airlift.

NASA's National Transonic Facility, a super wind tunnel used to provide engineering data to build space vehicles, required a continuous supply of liquid nitrogen. Skip Carr, then chief of the directorate's cryogenics organization, realized that shipping this product by truck would be impractical and hazardous. He presented NASA officials a concept of building a pipeline, and the $85 million project became a reality. The pipeline carried nitrogen at minus 320 degrees Fahrenheit with minimal losses. It was a great success for NASA and the directorate.

The Hydrazine Dilemma

A hydrazine disposal controversy took center stage for the directorate in the early 1980s. In 1982, the Air Force's hydrazine blending plant, located at the U.S. Army's Rocky Mountain Arsenal in Colorado, closed due to deactivation of the Titan II Missile Program. Controversy arose over clean up responsibilities. Initially, OSD requested clean up and decontamination responsibilities be placed with the Air Force. With assistance from the Armstrong Laboratory at Brooks AFB, Texas, the directorate established clean up procedures and monitored contractor efforts. However, in 1986, OSD gave official responsibility for the hydrazine clean up to the Army.

Other environmentally sensitive issues tackled by the Technical Branch in 1984 included magnetohydrodynamics, which dealt with increasing efficiency for coal fired plants, and the Used Solvent Elimination Program, which minimized disposal of used solvents and other fluids by reclamation.

Fuels Accounting Changes

In the fuels accounting arena, base-level computer problems continued to plague fuels accounting systems. To further complicate problems, the Air Force was in the process of replacing the 1050II computers on which accounting data was kept with newer 1100 computers. This meant directorate accounting personnel spent many hours of tedious tracking, correcting, and inputting data to ensure the information was accurate.

In 1983, the directorate established its first automated budget, an immense step forward but one which still required thousands of entries to create a reliable database for future transactions. By this time, the directorate financed approximately $5 billion of fuel for the Air Force.

An extensive financial change came about as part of the HQ Air Force Logistics Command Pacer Align reorganization in 1983. Air Force Logistics Command (AFLC), transferred the Worldwide Fuels Division, the Air Force Fuels Stock Fund, and the AFLC Command Fuels functions, all previously accomplished by headquarters personnel, to the directorate.

Wartime and Contingency Preparedness

As the Cold War continued into the mid-1980s, the focus of the Air Force and the Directorate of Energy Management remained on ensuring availability of resources to support weapon systems. The DoD conducted many exercises during this time period to ensure operational as well as logistics readiness, and the directorate was a key participant.

Emergency Operations Centers at Kelly AFB and at Cameron Station and the Functional Fuels Manager desk on the San Antonio Logistics Readiness Center (Battle Staff) were activated for numerous exercises. Exercises included Serene Fox 84, Powder River 85, Port Call 86, Present Arms 86, various Wintex-Cimex command post exercises, Powder Sweep 87, Proud Scout 88, and Proud Eagle 89. The directorate, in conjunction with the DFSC, conducted a Survival, Recovery and Reconstitution exercise in 1988. This exercise included deployment to alternate command sites in the northeastern part of the U.S. The practice during these exercises played a key role in the directorate's exceptional performance in real world contingencies

A New Name

In 1989, the name of the Directorate of Energy Management changed back to the Directorate of Aerospace Fuels. Why the change?

In 1988, the Air Force Energy Management Steering Group decided that the "Energy Management" title which evolved from the 1973 Energy Crisis no longer applied. Colonel Sanford A. Richardson, director at that time, noted that "our primary commodity is fuels, conventional and unconventional, everything from gasoline for cars and trucks to sophisticated propellants and gases for our space program. Our mission is managing fuels not energy."

Wartime Performance – Desert Storm

The value of the directorate's emphasis on preparedness in the 1980s paid off during Operations Desert Shield (1990) and Desert Storm (1991) when the U.S. and its United Nations coalition members fought to drive invading Iraqi troops out of oil-rich Kuwait.

Special fuels bladder in Saudi Arabia – Operation Desert Storm.

The directorate's Emergency Operations Center provided immediate responses to special fuels needs and fuels quality issues in Southwest Asia during this period. In all, the directorate facilitated the delivery of over 915 million gallons of aviation fuel for American and allied forces operating in theater.

The contributions made by the directorate went beyond supporting an enormous amount of fuel. Senior directorate technical and logistics experts, augmented by senior reservists, served as Fuels Functional Managers on the San Antonio Air Logistics Center battle staff in the Logistics Readiness Center. Detachment 29 at Cameron Station provided 24-hour coordination with the DFSC, HQ U.S. Air Force, and the Unified Commander to ensure the forces in the Middle East had the fuel they needed. The directorate also provided senior military personnel to augment the Pentagon's Crisis Center.

JPTS Fuel – Desert Storm.

Taif, Saudi Arabia – Operation Desert Storm.

Minuteman Missile Launch.

The 1990s – Fuels Management Re-engineering Era

Rapid Change in the 90s

Changes in the international and domestic political climate, brought about by the end of the cold war, ushered in an era of government downsizing and emphasis on balancing the federal budget. From this came a great push throughout DoD to combine like functions among the services - "purpling." As part of these consolidations, with an emphasis on joint service, the idea of merging directorate and Defense Energy Support Center (DESC) functions accelerated.

Exxon Baytown Refinery Manager Sherman Glass accepts appreciation from Colonel Sandy Richardson, recognizing 24 years of JP-7 supply for the SR-71.

Change continued at the end of 1989, with the retirement of the SR-71 Blackbird, which flew reconnaissance missions since its activation in 1966. The Director of Aerospace Fuels, Colonel Sandy Richardson, took the occasion to express appreciation to a vital special fuels partner, the Exxon Baytown, Texas, Refinery. They were an indispensable partner with the directorate in the SR 71 program, supplying over 450 million gallons of JP-7 throughout 24 years.

Re-emergence of Product Management

The business re-engineering strategy which took hold in the civilian sector with the advent of a quality revolution, became a way of doing business for DoD and directorate personnel. In 1990, AFLC directed each of its Air Logistics Centers to reorganize along product, rather than functional, lines. Under the resulting product directorate concept, managers of a system controlled almost everything that affected their program. For the directorate, that included finance, management, and contracting.

On October 1, 1990, the directorate was organized along product lines. This change included the addition of a matrixed Contracting Division with the physical co-location of 17 contract specialists.

In line with the complete product management emphasis within the command, the Directorate of Aerospace Fuels was renamed the Directorate of Aerospace Fuels Management.

PETROL RAM – Technology Insertion

With technological advances moving at lightning speed, the directorate was at the forefront in re-engineering with innovations based on new computerized information systems and fuels automation capabilities.

In 1989, the Fuels Automated Management System (FAMS) program began as a Air Force program management directive. PETROL RAM was a cornerstone of this program. It combined technologically advanced commercial-off-the-shelf fuels systems with accounting and data information systems to provide

automated data collection for fuels inventory and transactions.

The Air Force assigned program management of PETROL RAM to the directorate in 1991. The directorate tackled the challenge of developing, procuring, installing, and providing maintenance of the PETROL RAM hardware.

The PETROL RAM architecture included a triad of innovative enhancements to fuels supply systems by providing data to a central collection point. Interrelated hardware and software components consisted of Automated Fuels Service Stations, Automatic Tank Gauging, and Automatic Data Collection.

In May 1991, the Air Force Fuels Management Steering Group met in San Antonio. Issues addressed reflected the issues of the 1990s: fuel delivery concerns; environmental issues; the Combat Fuels Management System; and filters, separators, additive injection. Special interest items included FAMS and the related PETROL RAM program.

Technology Enhancements

As computer technology advanced in private industry, the directorate kept pace. Personnel served on and hosted the American National Standards Institute's X3T6 – Non Contact Information Systems Interface Technical Committee. This committee proposed military, industry, and international standards for non-contact data interfaces between radio frequency devices (e.g. transponders to interrogators). Commitments like this provided the Air Force and the DoD with state of the art automated enhancements and ensured future technological advancements for POL operations.

Aerospace laboratories began aggressively automating testing operations to increase cost effectiveness and productivity. This involved replacing older, manual test equipment with newer computer driven models employing auto-samplers and data recorders. This initiative increased sample workload processing capabilities in many testing areas by over 35 percent.

Beginning in the mid-1990s, aerospace laboratories also initiated efforts to automate their data management and reporting functions by installing a state-of-the-art commercial Laboratory Information Management System (LIMS) at each site and in its headquarters office at Kelly AFB. This dramatically enhanced laboratory operational effectiveness by providing management with an in-depth ability to view and analyze laboratory workloads. The LIMS system also enhanced the quality of support available to laboratory customers by providing them with electronic access to an extensive amount of data on the quality of the products they either use or manage. By the end of the nineties, the DoD was considering making this system the standard for all its petroleum testing laboratories, and using it as the Quality Module for the new automated fuels tracking system being developed by the Defense Logistics Agency.

By the end of August 1999, directorate computer specialists aggressively resolved year 2000 (Y2K) computer issues for the directorate's data systems, to include LIMS.

An Aging Fuels Infrastructure

Replacing aging fuel tanks became an Air Force priority in the 1990s and the Technical Assistance Team led the way. By participating in studies analyzing current and proposed methods for monitoring tanks, the team insured Air Force tanks met

Federal Underground Storage Requirements, bulk storage above ground tanks, and pipeline requirements.

At the April 1993 Air Force Fuels Management Steering Group, directorate personnel briefed API filter vessel modifications, liquid oxygen technical assistance, aviators' breathing oxygen testing, and a wide variety of FAMS related issues.

By 1993, DFSC's Integrated Material Manager Phase II study was underway. This program sought to implement the OSD goal to transfer complete management of fuels to a single control point.

Need For Advanced Fuels

As the U.S. Air Force's aircraft became more sophisticated, so did its fuel requirements. In 1993, conversion from JP-4 to JP-8 began in the U.S., almost 20 years after the issue initially appeared. In addition to its aviation safety benefits, fuel specialists looked to JP-8 to become the single fuel on the battlefield.

Due to a substantially higher flash point than JP-4, JP-8 improved safety margins for servicing personnel. It also improved the combat survival rate of aircraft. During the conversion process, aircraft leak problems caused by the changeover of fuels required technical solutions during the transition period.

JP-8+100 –Technology Breakthrough

Jet engines generate extreme heat during flight. To relieve excessive heat, fuel is used to cool engine and other aircraft components. Advanced fighter aircraft engines generate heat at or even above, the thermal stability of JP-8, causing the fuel to break down into gums and varnishes, hardening, then clogging or distorting critical engine nozzle injectors. This build up of hardened fuel deposits is known as coking. To combat coking, the thermal stability of JP-8 must be increased. In 1992, Wright Laboratories developed an additive package to increase the thermal stability of JP-8 by 100 degrees Fahrenheit, and JP-8+100 was born.

JP8+100 injection equipment inspected by Mac Fishburn (left) and Frank Morse of the POL Technical Assistance Team.

AFMC assigned the directorate's Technical Division to serve as program manager for the JP-8+100 program. The POL Technical Assistance Team immediately went to work. The test program started with one implementation of an Air National Guard fighter wing. Aircraft maintenance data obtained approximately one year after converting to JP-8+100 was positive. Use of JP-8+100 reduced engine maintenance and operating costs for most aircraft using the additive.

The program implementation process consisted of establishing and coordinating special operating procedures; contracting and ordering new filter cartridges for refuel trucks at all Air Force locations; installing additive injectors and tanks; and training fuels personnel at each implementation site on the entire JP-8+100 process. Between

1993 and 1999, the directorate implemented the JP-8+100 program at approximately 70 U.S. Air Force, Air National Guard, and Air Reserve bases.

Environmental Issues

Environmental issues also remained a priority. By 1993, several of the directorate's laboratories, including the ones at Cape Canaveral and RAF Mildenhall, greatly expanded support to their customers' environmental testing needs. This testing includes Toxicity Characteristic Leachate Procedures which determines the mobility of both organic and inorganic contaminants present in wastes.

These efforts assisted Eastern Test Range customers in meeting statutory mandates required for waste disposal under EPA regulations. This support, required by July 1992 EPA mandates, was a mission critical component of the launch cycle for Atlas, Delta, and Titan rockets and the space shuttle and its associated payloads.

In meeting another environmental commitment, the Product Engineering and Laboratory Branches provided assistance to Air Force and NASA customers in developing solutions to international treaty obligations, requiring eventual reduction and eliminating the use of chlorofluorocarbons.

Internal Revenue Service Support

The directorate's mission continued to expand. In 1994, it began a testing program for the Internal Revenue Service (IRS). This "Red Dye" program came from a 1994 federal law that established a mechanism for monitoring distribution and use of non-taxed diesel fuels. Tax-exempt diesel fuels were dyed red to distinguish them from taxed fuels. Prior to this, the nation lost significant tax revenue from improper use of non-taxed fuels.

The directorate signed a memorandum of agreement with the IRS to provide the laboratory testing support to enforce this federal law. The successful result was that excise tax revenues from the sale of diesel fuel increased by more than $1 billion with another $350 million in penalties against violators in FY94 (the first year of implementation) due to this diesel fuel marker program. Until 1999, aerospace laboratories provide sample analysis, special studies, and technical assistance to the IRS.

In 1996, the aerospace laboratories mission expanded to include testing "below the rack" fuel samples for the presence of hazardous materials being improperly injected into the nation's fuels supplies.

Russian Missile Defueling

The end of the cold war brought about the establishment of an interlocking European Security Architecture. NATO's Partnership for Peace established new models for cooperation between the West and the former Warsaw Pact countries. Russia, former Soviet Union countries, and the U.S. initiated major steps to comply with the first Strategic Arms Reduction Treaty.

The former Soviet Union nations required significant technical and financial assistance to reduce their atomic arsenals, including deactivating liquid rocket fuels. In 1992, directorate personnel helped the Defense Nuclear Agency by providing technical assistance to facilitate Russian and former Soviet Union countries' efforts to defuel and dispose liquid rocket fuels.

Directorate experts Frank Heyde and Gilbert Noriega traveled to Russia, the Ukraine, and Byelorussia to expedite the

assistance of the U.S. and France in providing bulk containers for the rocket fuels. This effort facilitated movement of liquid propellants by railroad cars in intermodal containers since the highway system was not appropriate for these transports. In 1997, Mr. Noriega received the Office of the Secretary of Defense Award of Excellence for his contributions to this international program.

Specialized U.S. Government Programs

In addition to the logistics and technical support involved in the drawdown of the U.S. nuclear missile force, directorate missile fuels managers also assumed increased roles in resolving special fuels issues of DoD as well as NASA launch systems. Supply for Titan IV, designed for military space use, required new fuels logistics support. NASA and the directorate established written agreements to support NASA propellant requirements.

The two organizations drew up a special agreement for the shipment of nitrogen tetroxide to the Kennedy Space Center and the White Sands Test Facility in New Mexico. The directorate's decision to transport only gaseous fluorine in support of Ballistic Missile Defense Systems resolved a grave safety concern of transporting very volatile liquid fluorine across America's highways.

The purchase of bulk gaseous helium also presented a challenge. With the Bureau of Land Management shutting down its retail bulk gaseous helium business, directorate personnel had to develop innovative strategies to obtain this product. These initiatives resulted not only in an uninterrupted product supply but also at a lower cost to the customer.

Fluorine transport trailer.

Facilitating Change:
Military – Industrial Partnerships

In February 1995, the directorate sponsored PETRO 95, the first worldwide petroleum conference in San Antonio. PETRO 95 was a government and industry fuels conference hosted by the Air Force fuels logistics and engineering communities and their Air Staff counterparts, the Air Force Fuels Management Steering Group, DFSC, and the National Petroleum Management Association. The conference brought together representatives from the entire defense fuels community from base level to major command staffs and other services together with the fuels and petroleum industry.

In March 1995, at the Twentieth Annual Fuels Management Steering Group conference, the directorate and Headquarters Air Force Supply and Fuels Policy Division agreed to lead an effort to establish a strategic plan for the fuels community. This effort recognized the need to develop a fuels vision for tomorrow's Air Force to meet the ongoing and rapid changes that the fuels community was facing.

A year later in March 1996 at the Twenty-First Annual Fuels Management Steering Group, Air Staff representative

Jack Lavin presented the Air Force Fuels Strategic Plan. This plan was an integral part of OSD's effort to transform logistics through reengineering, increase efficiency with advanced technology, and modernizing information systems.

PETRO 97 – Fuels in the Next Millennium

The directorate hosted a worldwide petroleum conference in San Antonio called PETRO 97. Similar in nature to PETRO 95, this conference greatly expanded industry participation. It addressed key issues and concerns facing fuels in an era of severely constrained budgets. "Building a Bridge to the Next Millennium" was the recurring theme. Jack Lavin expertly orchestrated this POL community event.

This joint government and industry fuels conference included not only traditional fuels managers but also logistics and engineering personnel. The resulting scope was impressive, with over 800 participants attending more than 55 workshops.

PETRO 97 included a joint fuels mobility support deployment. The Army demonstrated the rapid set up of its new Advanced Aviation Forward Area Refueling System, Inland Petroleum Distribution Systems, Tactical Pipeline system, and fuels bladders. The Air Force Special Operations Command demonstrated a forward air refueling point mission.

1997: A Transition Year

Other events marked 1997 as a transition point. A major initiative tackled by Rick Gohn and the financial division was the establishment of an aircraft off-station fuel purchase program (AIRCARD). This initiative not only eliminated cumbersome documentation requirements for the aircrews and wing finance personnel, but also provided for complete reimbursement of transactions to the Air Force Working Capital Fund (AFWCF). Also, the creation of a Cost of Operations Division (COD) liaison office as the Defense Accounting and Finance System took over many Air Force financial responsibilities. The directorate also transferred its cataloguing function to the Cataloguing and Standardization Center in Michigan.

The 1997 Tactical High Energy Laser Program was another priority program for directorate attention. The laser was a joint U.S. and Israeli program to develop a laser capable of destroying short-range rockets and artillery rounds in flight. The directorate provided the required special fuels, including nitrogen triflouride, gaseous helium, deuterium, and hydrogen peroxide.

Overseas support of JPTS caused numerous challenges. Through on-site negotiations in Southwest Asia, a team of directorate employees developed the first fixed fuel storage capability for special fuels on the Arabian Peninsula. With fixed storage capability, special fuels could be delivered via a one million-gallon capacity ship instead of 6000-gallon fuel container or 55-gallon drums. Directorate officials also arranged for similar logistical support for Pacific Air Forces, eliminating the use of railcars for special fuel storage at Osan Air Base, Korea.

Serene Response

From 1964 to 1999, the Air Force safely transported dinitrogen tetroxide (N_2O_4) over the nation's highways and rail systems. This highly lethal oxidizer is transported in specially designed trailers and rail tank cars. Although Department of

Transportation (DOT) regulations prohibited the transportation of N_2O_4 over the highway system, the directorate's restriction was exempted.

Beginning in 1989, DOT imposed new requirements on these shipments, including development of an emergency response plan to mitigate any N_2O_4 leaks or spills that might occur during the transportation of the product. Additionally, DOT required the directorate to test the emergency response plan every two years.

Serene Response N_2O_4 exercise.

By 1998, the directorate conducted six highway and one rail exercise. These inter-agency exercises, called Serene Response**,** involved staged train derailments and highway accidents and are favorite subjects of the news media. Directorate officials are proactive in responding to the media during these exercises, demonstrating a commitment to safe transport of chemicals critical to national defense.

Recognition – 1998

In November 1998, the directorate received the 1998 Major General Frederick J. Dau Award – Materiel Group Manager Team of the Year. The crystal trophy and a citation signed by General George T. Babbitt, Commander of U.S. Air Force Materiel Command, recognized the superior performance of the directorate's materiel management and focus on customer satisfaction.

Colonel Pharris (PJ) Johnson, Director of Aerospace Fuels, accepts 1998 AFMC Dau Award for the directorate – presented by Brig Gen Robert P. Bongiovi.

Support to the Warfighter

By the end of the 1990s, major operations required directorate support. In March 1999, NATO air forces in Operation Allied Force began enforcing the organization's commitment to protect the rights of ethnic Albanians living in the Kosovo province of Yugoslavia. Joint Task Force Shining Hope, an allied humanitarian effort to provide supplies, tents, and food to the Kosovo refugees in Albania and Macedonia. Directorate personnel served long hours, both overseas and at home, to insure all fuel support requirements were met.

During the decade of the 1990s, the directorate reflected the vision of an environmentally responsive team, efficiently fueling the forces into the 21st century.

The Directorate of Aerospace Fuels Management

Life Force of Air Force Worldwide Fuel Logistics

2000 & On - Transitions into the 21st Century

The 1995 Base Realignment and Closure Commission decision to close the San Antonio Air Logistics Center and realign Kelly AFB, greatly impacted the directorate's future. A General Officer Steering Group met in January 1996, and decided most of the directorate's functions would transfer to DESC.

The transferring activity includes financial working capital fund, missile fuels management, contracting, and most of the directorate's aerospace fuels labs. The Air Force will retain a quality and technical function, which will become the Air Force Petroleum Office**.**

After the decision to transfer most of the directorate's functions, DESC subsequently determined, through a business case analysis, that it wanted to leave its transferred operation in-place at the former Kelly AFB and took steps to retain the necessary facilities.

A new accounting/financial program, the Fuels Accounting System, is under development by DESC. This new system allows the Air Force Working Capital Fund to transfer to the DESC Working Capital Fund (a precursor for the transfer). This system is now slated for completion in 2001, with the transfer scheduled at the end of that fiscal year. In October 2000, an interim alignment under Warner Robins ALC takes place until the 2001 transfer.

These transitions define a new era for Air Force aerospace fuels management. The directorate's objective is to make this transfer seamless to the customer and ensure that mission support is the top priority. The legacy of the Aerospace Fuels Management Directorate dictates that its customers continue to receive quality fuel and missile propellants support, worldwide, on time, at the right price, and at the right place…in war or peace.

Aerospace Fuels personnel, July 1999.

The Commitment Continues

Like its predecessors, today's directorate and its future successors stand ready and committed to meet new challenges as missions, technology, aircraft, and fuels bring the Directorate of Aerospace Fuels Management into the 21st century.

F-15 In-flight Refueling

"to provide quality fuel and missile propellants support to customers worldwide, on time, at the right price, and at the right place … in war or peace"

APPENDIX 1

DIRECTORS OF AEROSPACE FUELS MANAGEMENT

1952 – 1999

Colonel David L. Dinning
1999 –

Colonel Pharris D. (PJ) Johnson
1996 –1999

Colonel Grat H. Horn
1991 - 1996

Colonel Sanford A. Richardson
1983 –1991

Colonel Richard A. Martin
1981 - 1983

Colonel Donald E. Evans
1979 - 1981

Colonel James S. Knox
1977 – 1979

Colonel Merle W. Nash
1975 -1977

Colonel Ralph R. Moulton
1972 – 1974

NOTE: Deputy Director Oliver R. Johns served also as Director from 1 September 1974 to 30 June 1975

Colonel Alfred D. Hagen
1971-1972

Colonel Bayard V. Grant
1969 - 1971

Colonel William E. Steger
1968 -1969

Colonel Carleton G. Shead
1961 - 1968

Colonel Wilson A. Chapman
1958 – 1961

Colonel Douglas R. Brown
1955 – 1958

Colonel Edward J. Fourtico
1952 – 1955

APPENDIX 2

POL TECHNICAL ASSISTANT TEAM CHIEFS (MILITARY)

MAJ DICK EMANUELSON	FEB 64 – DEC 64
MAJ VINCE BENNETT	DEC 64 – JUN 65
LT COL RAY SHARP	JUL 65 – JUN 67
LT COL DICK MULCAHY	AUG 67 – JAN 68
MAJ CHUCK NIDA	FEB 68 – JUN 69
LT COL JIM SIROCKMAN	JUN 69 – JUN 70
MAJ DWIGHT BROWN	JUL 70 – DEC 71
MAJ ED FACKLER	FEB 72 – JUL 73
MAJ BOB MATHISON	JUL 73 – AUG 74
CAPT DOUG PERKINS	SEP 74 - JUL 75
LT COL HANK KOHL	SEP 75 – JUL 76
MAJOR JIM COLVIG	AUG 76 – JUN 78
LT COL GOMER CUSTER	JUL 78 – NOV 79
MAJ HOUSTON SORENSON	NOV 79 – JUL 80
MAJ BRIAN RUCHALSKI	JUL 80 – MAY 82
MAJ LARRY DIPOMA	JUL 82 – JUN 84
MAJ MAXIE HOWARD	JUL 85 – AUG 87
MAJ BRUCE HOVER	AUG 87 – JUL 91
MAJ BILL FIELDER	JAN 91 – SEP 92
MAJ LYMAN SHANNON	SEP 92 – AUG 94
MAJ KEN POLK	SEP 94 – MAY 96

APPENDIX 3

AMERICAN PETROLEUM INSTITUTE TROPHY WINNERS

YEAR	BASE	COMMAND
1966	TRAVIS AFB, CA	MAC
1967	NAHA AB, OKINAWA	PACAF
1968	ANDERSEN AFB, GUAM	SAC
1969	MOUNTAIN HOME AFB, ID	TAC
1970	TYNDALL AFB, FL	ADC
1971	TYNDALL AFB, FL	ADC
1972	MOUNTAIN HOME AFB, ID	TAC
1973	CARSWELL AFB, TX	SAC
1974	HICKAM AFB, HI	PACAF
1975	NO COMPETITION	
1976	HICKAM AFB, HI	PACAF
1977	HICKAM AFB, HI	PACAF
1978	HICKAM AFB, HI	PACAF
1979	MCCONNELL AFB, KS	SAC
1980	MINOT AFB, ND	SAC
1981	HICKAM AFB, HI	PACAF
1982	TORREJON AB, SP	USAFE
1983	RHEIN-MAIN AB, GE	USAFE
1984	LUKE AFB, AZ	TAC
1985	REESE AFB, TX	ATC
1986	HOMESTEAD AFB, FL	TAC
1987	DYESS AFB, TX	SAC
1988	TYNDALL AFB, FL	TAC
1989	DYESS AFB, TX	TAC
1990	LUKE AFB, AZ	TAC
1991	KADENA AB, OKINAWA	PACAF
1992	NELLIS AFB, NV	ACC
1993	CHARLESTON AFB, SC	AMC
1994	MOODY AFB, GA	ACC
1995	HOLLOMAN AFB, NM	ACC
1996	BARKSDALE AFB, LA	ACC
1997	MISAWA AB, JAPAN	PACAF
1998	DYESS AFB, TX	ACC

APPENDIX 4

Organizational Dates

DoD Central POL Procurement and Management

1941	Petroleum Coordinator for National Defense	Secretary of the Interior
1942	Petroleum Administrator for War	Secretary of the Interior
1943	Joint Army/Navy Petroleum Board	Army/Navy
1943	Overseas Area Petroleum Offices	Overseas Commands
1945	Joint Army-Navy Petroleum Purchasing Agency	All Services
1948	Armed Services Petroleum Board	All Services
1949	Munitions Board Petroleum Committee	OSD
1951	Petroleum Administrator for Defense	OSD
1953	Petroleum Logistics Division	OSD
1956	Single Manager Assignment	Navy
1957	Military Petroleum Supply Agency	OSD

Air Force Aerospace Fuels

1952 Fuels Division, Directorate of Supply and Lubricants,
Middletown Air Material Area (AMA) – Olmsted AFB, PA
1957 Directorate of Air Force Aerospace Fuels, Middletown AMA
1959 Air Force Petroleum Directorate, Middletown AMA
1960 Directorate of Air Force Petroleum and Chemicals, Middletown AMA
1961 Directorate of Air Force Aerospace Fuels, Chemicals and Petroleum Products
1966 Transfer of Directorate of Air Force Aerospace Fuels from Middletown to San Antonio AMA, Kelly AFB, TX, on 19 August 1966
-- Aerospace Fuels Petroleum Supply Office established at Cameron Station, VA
1969 Directorate of Aerospace Fuels – San Antonio AMA
1975 Directorate of Energy Management – San Antonio Air Logistics Center (ALC)
1989 Directorate of Aerospace Fuels – San Antonio ALC
1990 Directorate of Aerospace Fuels Management – San Antonio ALC
2000 Directorate of Aerospace Fuels Management – Warner Robins ALC, Robins AFB, GA
--Personnel remain in San Antonio as operating location
2001 Transfer of Commodity Business Areas and Labs to Defense Energy Support Center
--Operating location in San Antonio
2001 Establishment of Air Force Petroleum Office – Warner Robins ALC
--Headquarters at Ft Belvoir, VA
--Operating location for laboratory at Wright-Patterson AFB, OH
--Operating location in San Antonio (Technical Team, Product Engineering)

APPENDIX 5
GLOSSARY

ACC	Air Combat Command
ADC	Air Defense Command
AFPET	Air Force Petroleum Office
AFWCF	Air Force Working Capital Fund
ALC	Air Logistics Center
ALCM	Air Launched Cruise Missile
AMA	Air Materiel Area
AMC	Air Materiel Command
API	American Petroleum Institute
ATC	Air Training Command
CONUS	Continental U.S.
DESC	Defense Energy Support Center
DEW	Distant Early Warning
DFSC	Defense Fuels Supply Center
DoD	Department of Defense
DOT	Department of Transportation
DSA	Defense Supply Agency
EPA	Environmental Protection Agency
FAMS	Fuels Automated Management Systems
FY	Fiscal Year
ICBM	Intercontinental Ballistic Missile
IMA	Individual Mobilization Augmentees
IRS	Internal Revenue Service
JP	Jet Propulsion
JPTS	Jet Propulsion Thermally Stable
LIMS	Laboratory Information Management System
MAC	Military Airlift Command
N_2O_4	Dinitrogen Tetroxide
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
OSD	Office of the Secretary of Defense
PAC	Pacific Air Forces
POL	Petroleum, Oil, And Lubricants
RAF	Royal Air Force
SAAMA	San Antonio Air Materiel Area
SAC	Strategic Air Command
SOAP	Spectrometric Oil Analysis
SMS	Synchronous Meteorological Satellite
STANAG	Standard Agreements (NATO)
TAC	Tactical Air Command
UDMH	Unsymmetrical Dimethylhydrazine
USSR	United Soviet Socialists Republic
Y2K	Year 2000